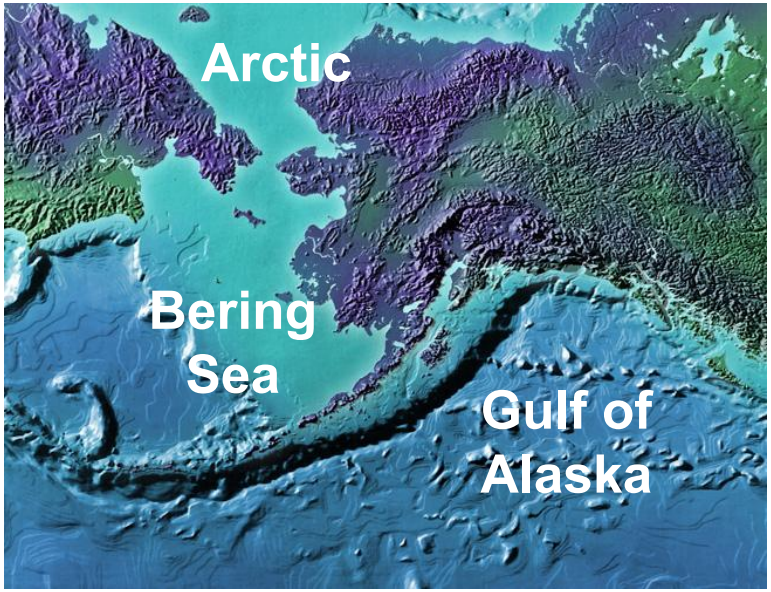
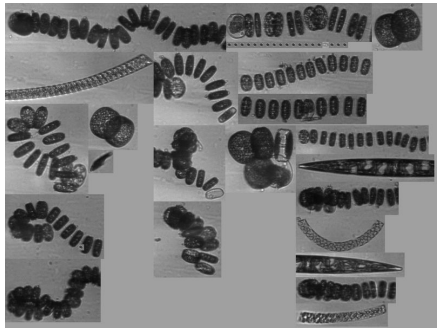
AFSC Lower Trophic Level Understanding and Process Studies

Janet Duffy-Anderson

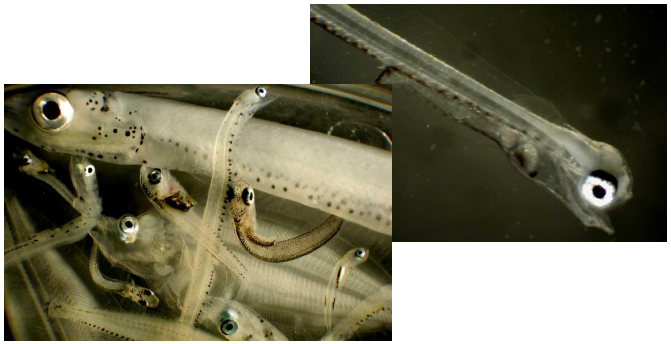
Ecosystem Science Review
Juneau, Alaska
May 2-6, 2016





Phytoplankton
(Eisner, Gann)

Zooplankton
(Napp, Eisner, Cieciel, Heintz, Kimmel)



Ichthyoplankton (fish eggs & larvae)
(Matarese, Duffy-Anderson, Rogers, Porter)

Juveniles and Forage Fishes
(Farley, Heintz, Moss, Wilson, Rogers, Siddon, Strasburger, Andrews)

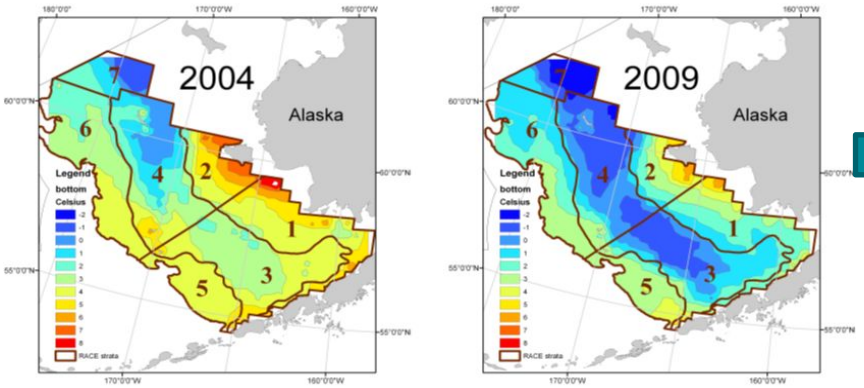
Phytoplankton

Are there relationships between phytoplankton production and fisheries dynamics?

Example from Bering Sea

(2001-2005) Warm Cold (2006-2012)

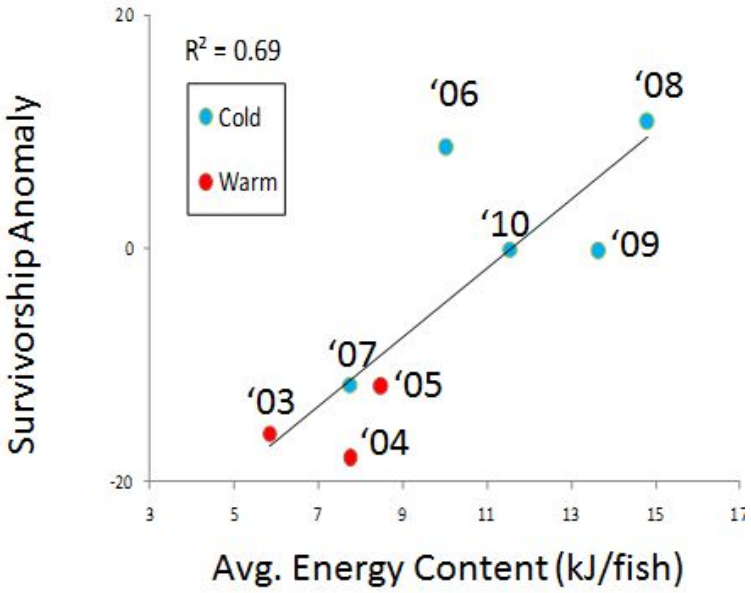
Poor for pollock



Good for pollock

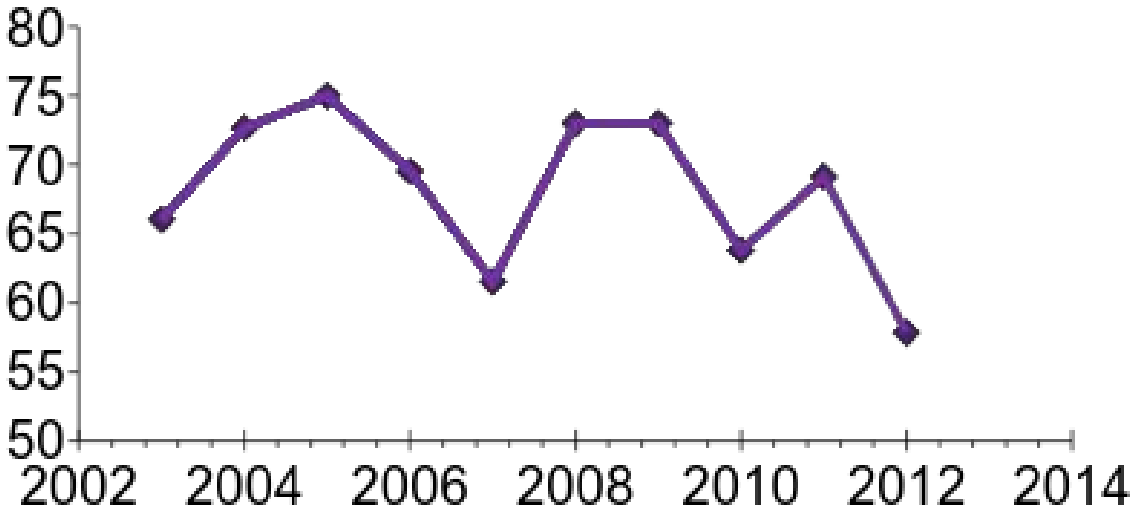
BUT 2007 WAS COLD AND NOT SO GOOD FOR POLLOCK

Age-0 pollock

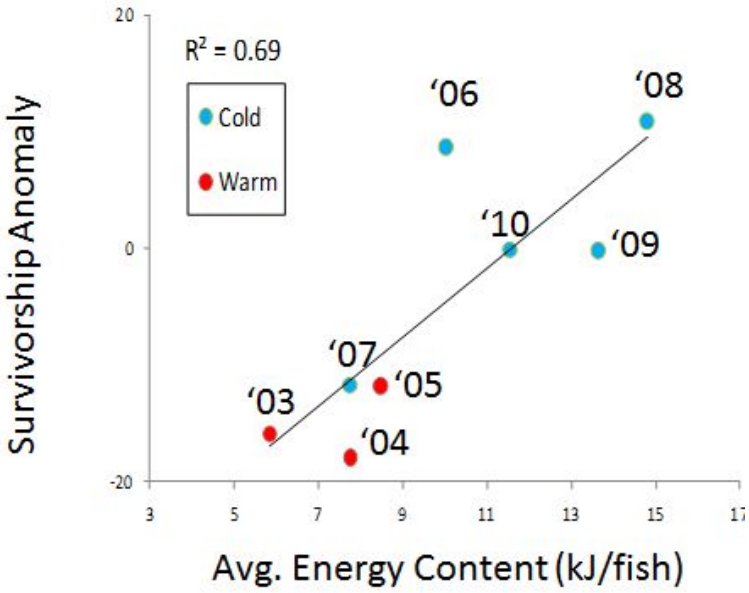


Heintz et al. 2013

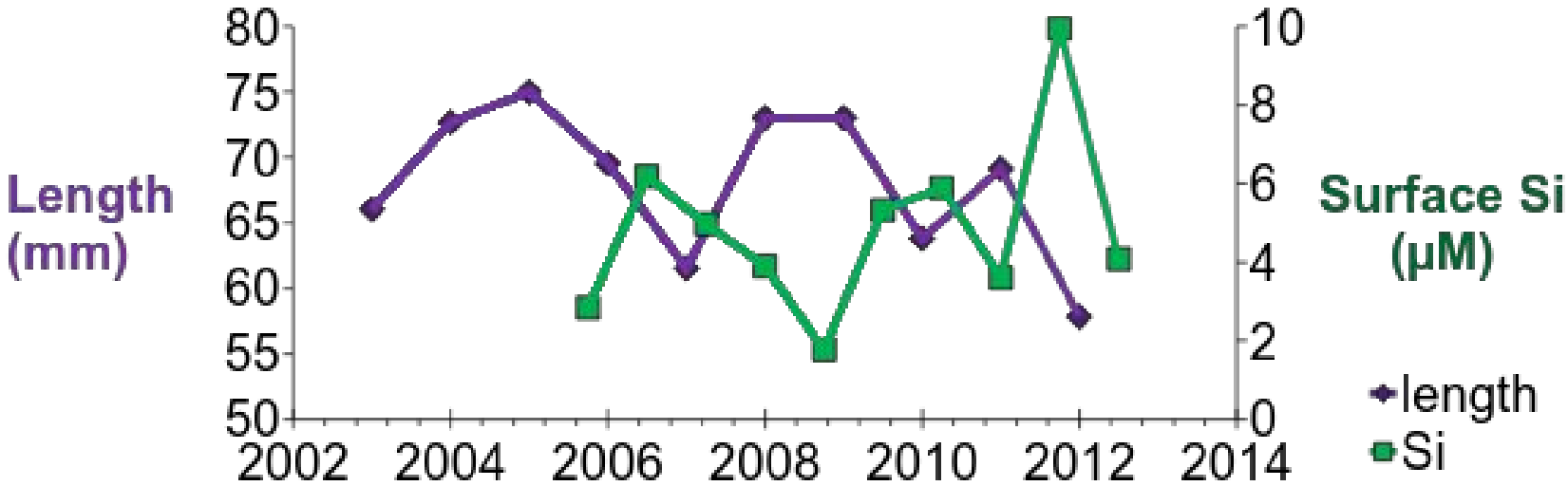
Length (mm)



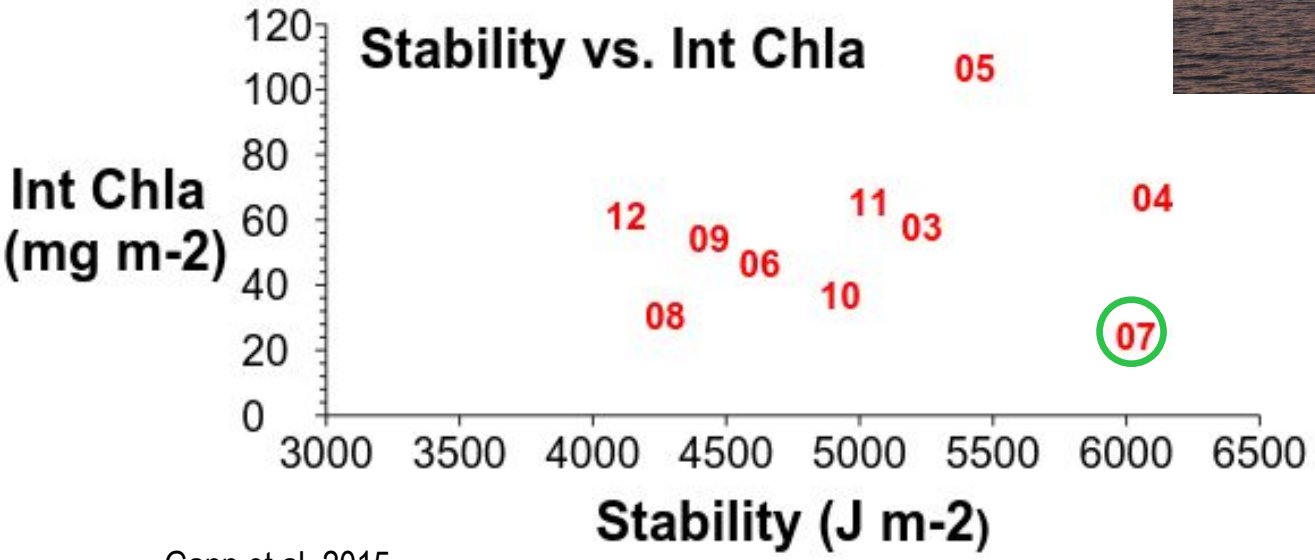
Age-0 pollock



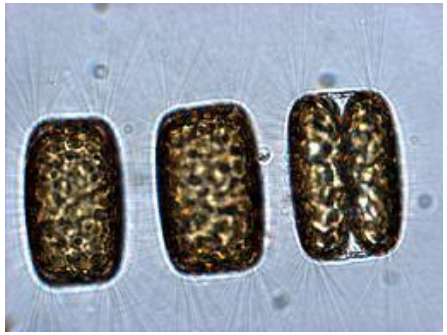
Heintz et al. 2013



STORY? Relationship between water column stability, nutrients, phytoplankton, zooplankton and fish



Gann et al. 2015



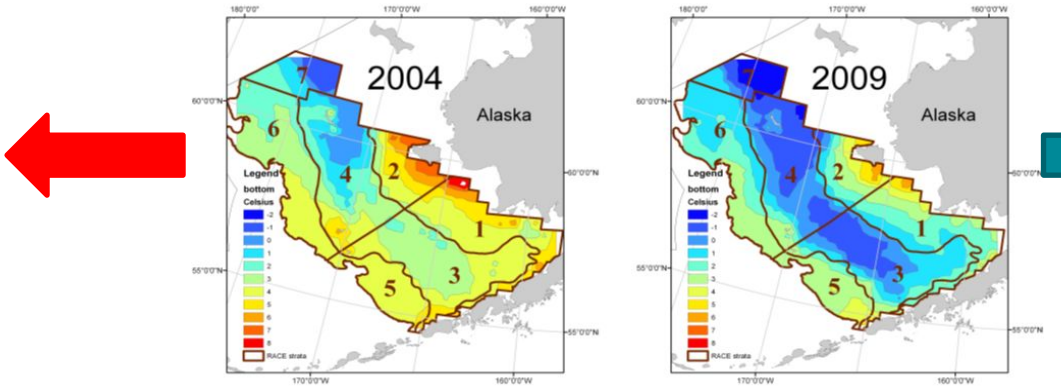
Zooplankton (crustacean)

Are there relationships between zooplankton production and fisheries dynamics?

Another example from Bering Sea

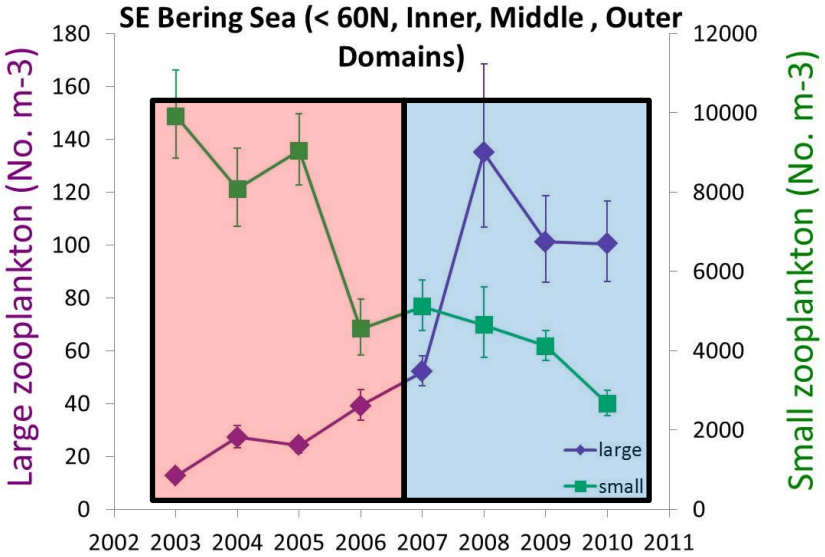
(2001-2005) Warm Cold (2006-2012)

Poor for pollock

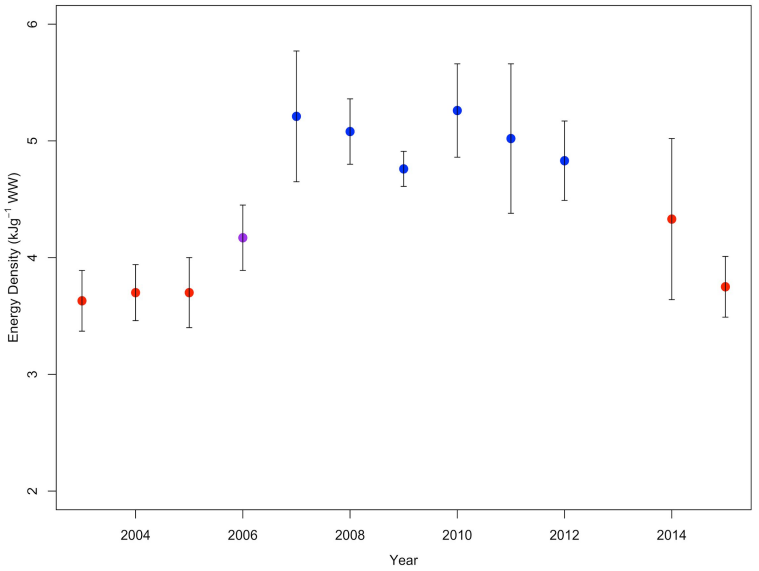


Good for pollock

STORY? Relationship between zooplankton community composition and fish production

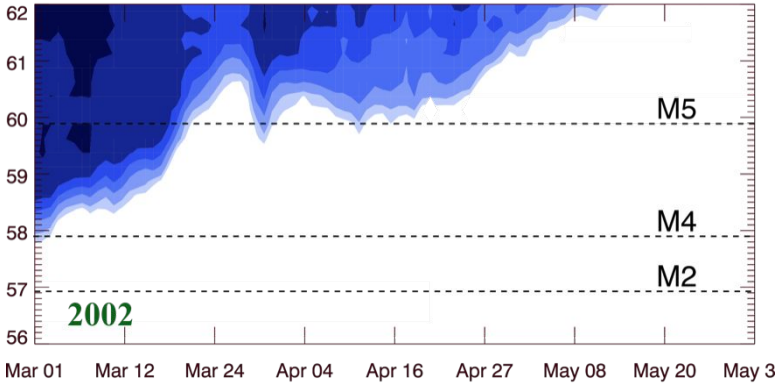


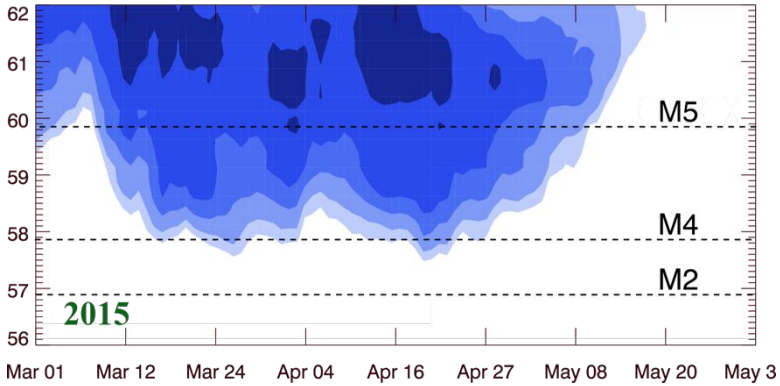
Eisner et al. 2014



Courtesy E. Siddon and R. Heintz, updated from Heintz et al. 2013

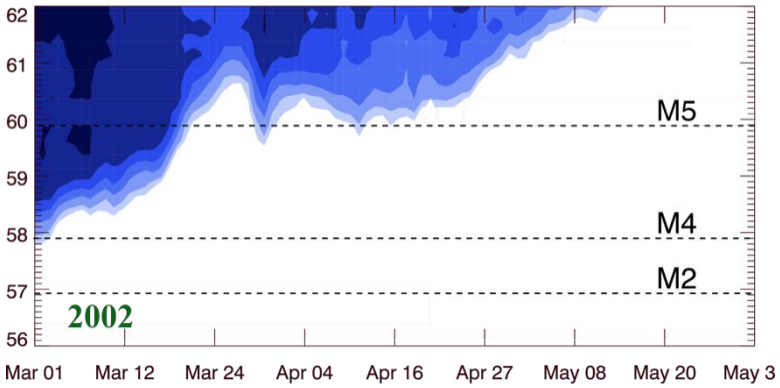
Mechanism? Sea ice

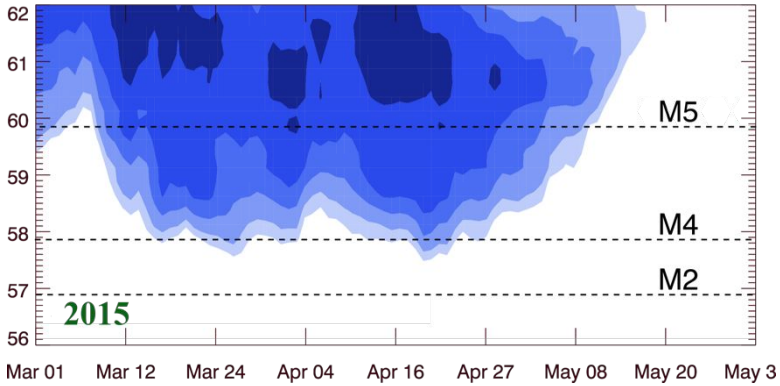


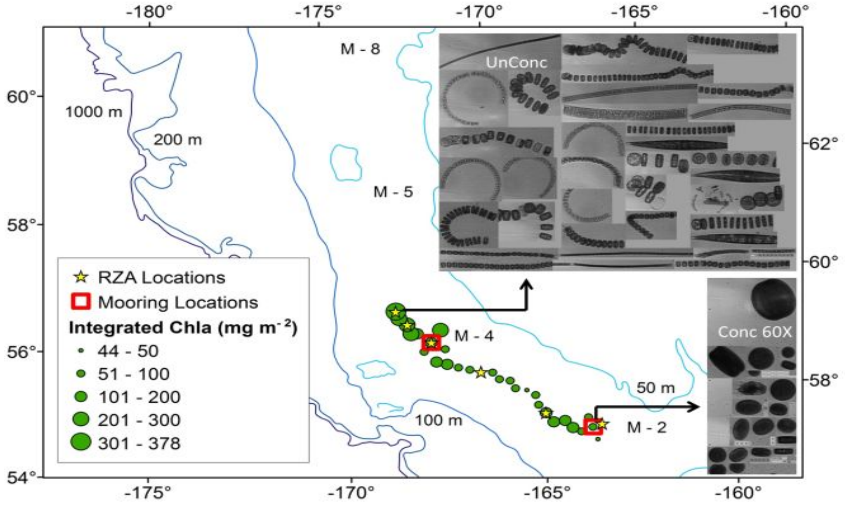


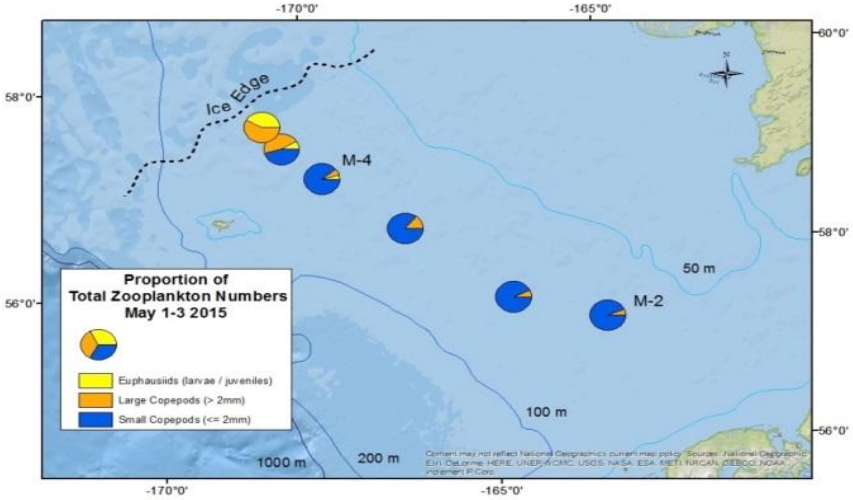
MOVIE

Mechanism? Sea ice



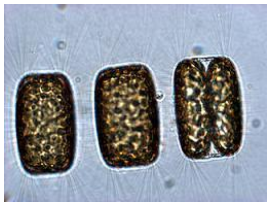


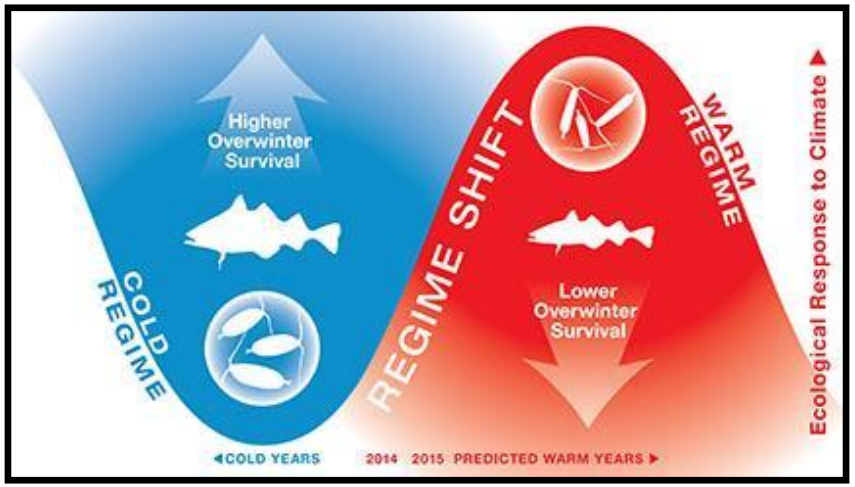




2015 Bering Sea Ecosystem Survey supported by NOAA Fisheries S&T **THANK YOU**

Pathway: mechanisms

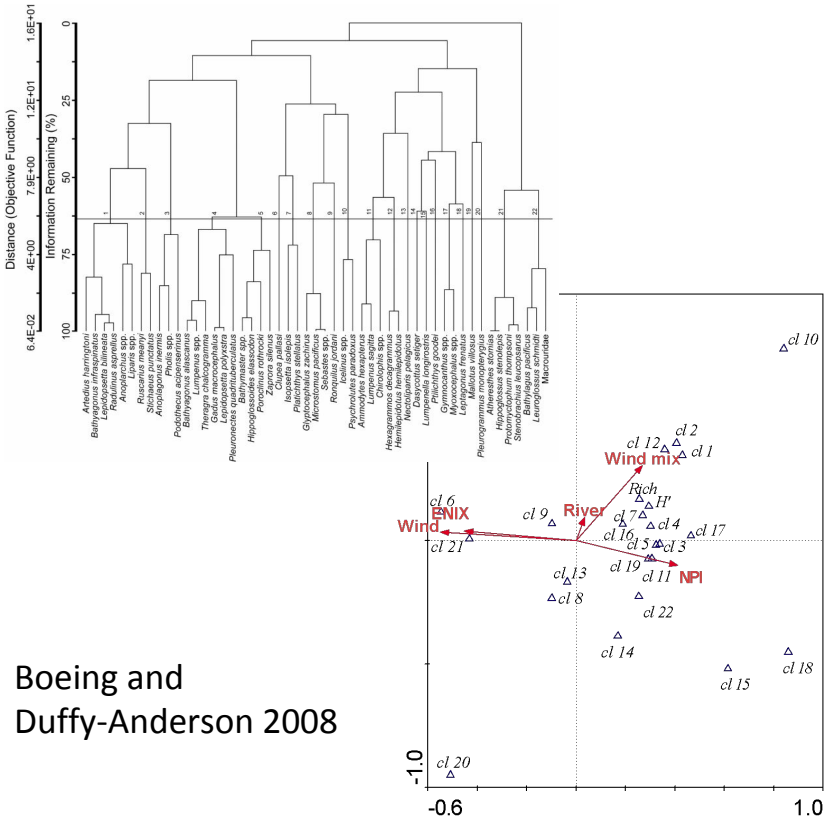




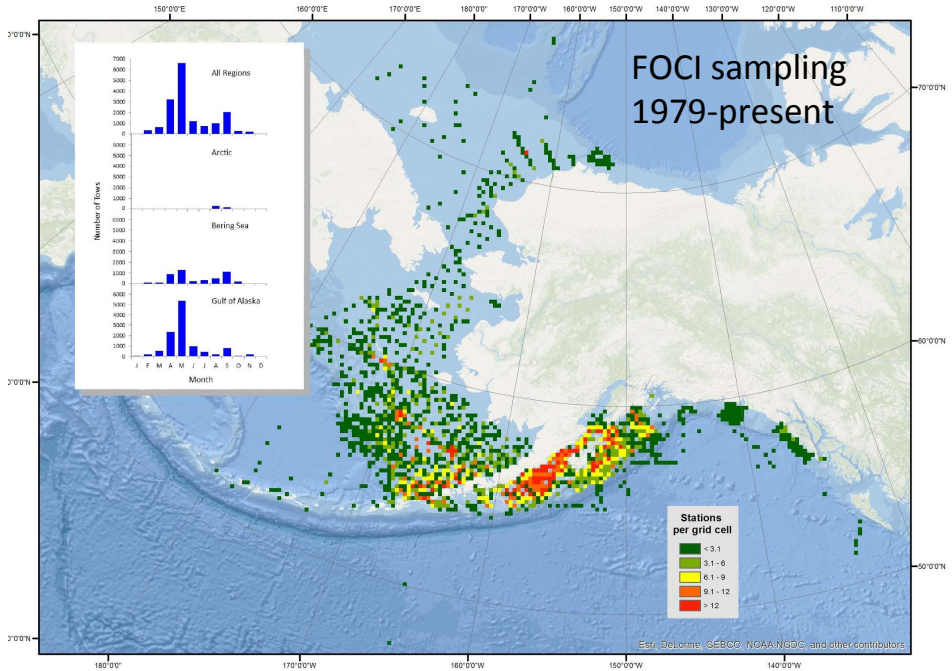
NOAA Tweet Chat [#AKwarmwater]

Ichthyoplankton (larval fish)

STORY? Ichthyoplankton as sentinels of climate change



Boeing and
Duffy-Anderson 2008

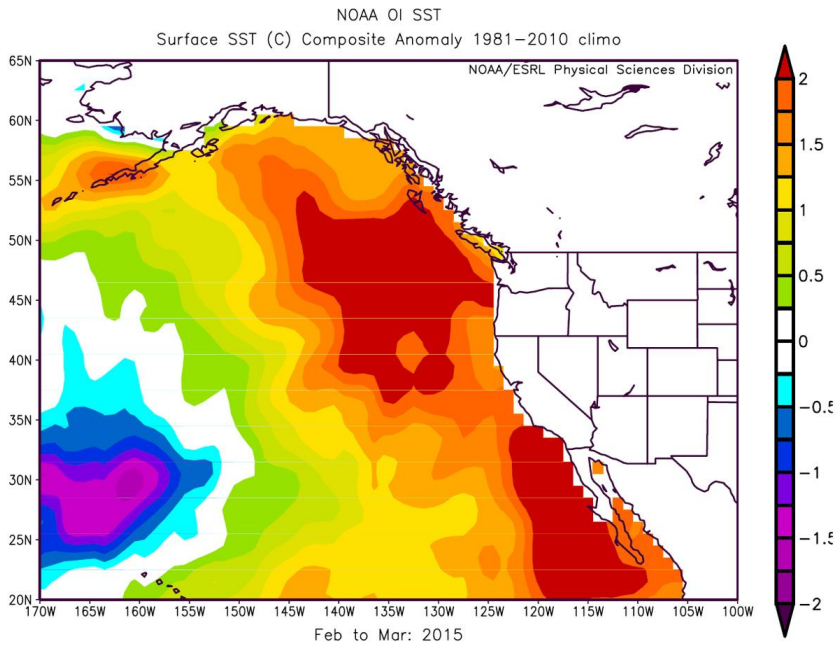


New FATE Project: Ichthyoplankton Metrics
AFSC - FOCI
SWFSC - CalCOFI
NWFSC - Newport Hydrographic Line
IMECOCAL, DFO

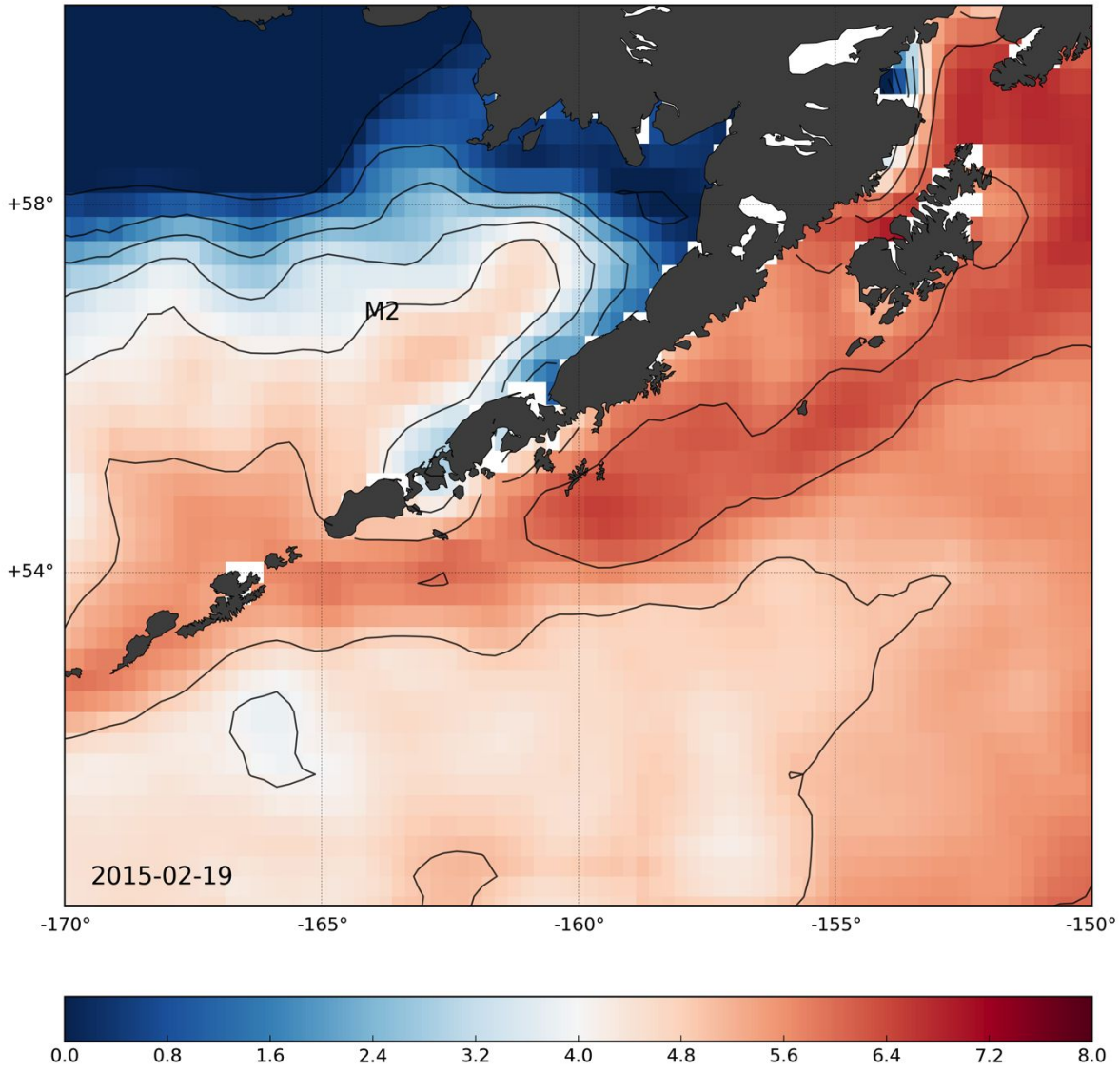
NOAA FISHERIES

Forage Fishes

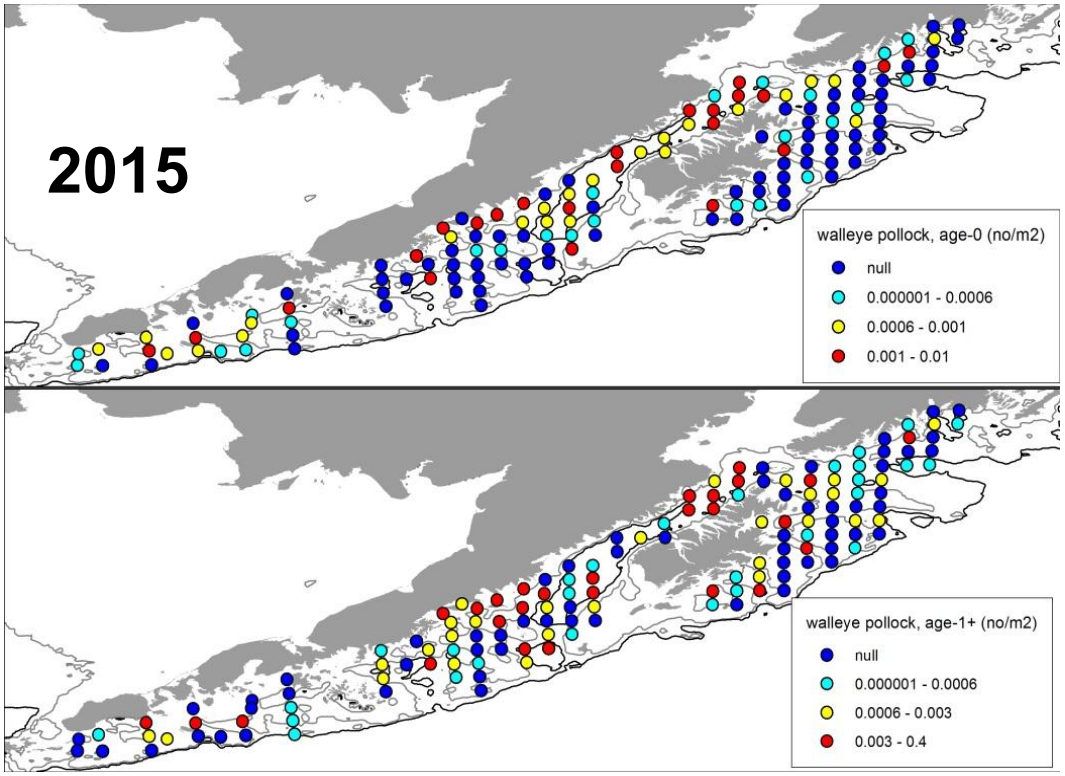
STORY? Climate-mediated shifts in forage fish base influence upper trophic dynamics

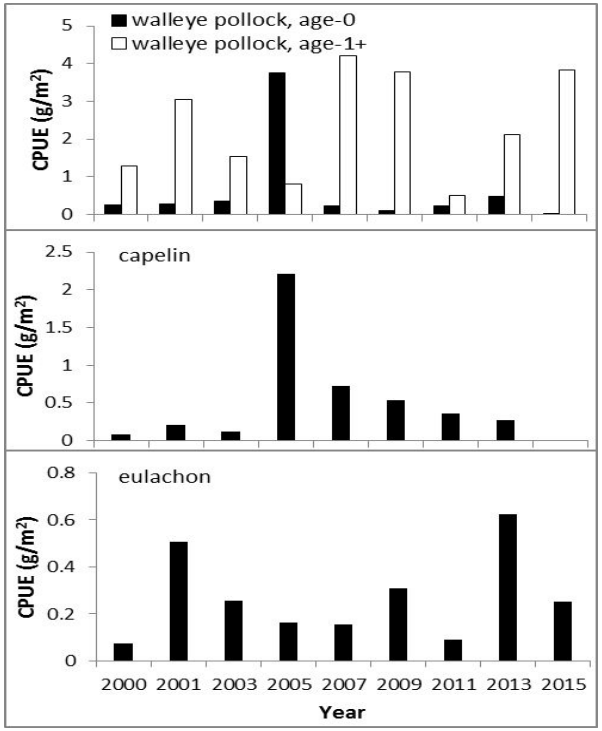


Heat in WGOA


+58°
+54°
M2
2015-02-19
-170°
-165°
-160°
-155°
-150°
0.0
0.8
1.6
2.4
3.2
4.0
4.8
5.6
6.4
7.2
8.0

Forage Fishes



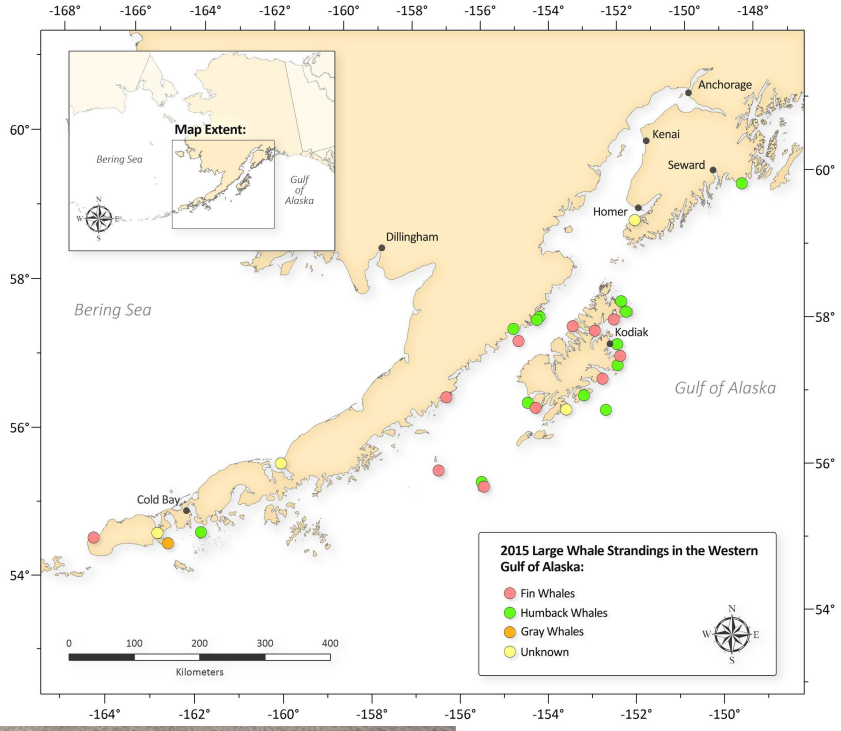


(Wilson in progress)

Mortality events

Alaska Dispatch News

[Massive seabird die-off lines Whittier beaches with carcasses](#)
Zaz Hollander January 5, 2016



Associated Press

[Starvation](#) suspected in massive die-off of Alaska seabirds
Dan Joling Jan. 12, 2016

New funding – partners UAF, USFW, USGS

An 'unusual mortality event' leaves 30 whales dead in Alaska, scientists baffled
August 24, 2015

CCTV AMERICA

Terms of Reference

- Strategies to obtain/manage data - in house relational databases, strive for 1-year turnaround (chla, plankton, otoliths, diets, catch, size, composition, on-board indices of plankton, diets), PARR, public sites (NODC, IIS, AOOS, NCEAS, NPRB, COPEPOD), public dissemination through media outlets
- Inclusion into management - Ecosystems Considerations chapter, Species-specific report cards, presentations at SCC and Council meetings
- Peer-review - special volumes, CIE Review 2015, discussions with AFSC Leadership, Leads for RPA
- Communication - special symposia, AFSC Hot Topics, Twitter, radio, & print interviews, presentations in local communities, science days outreach

Strengths, Challenges, Solutions

-Cross-trophic investigations - physics to fish; energy transfer, linkages, bottlenecks

-Long time series (multi-decadal) - track trends, provide context for variability, anomalies identified quickly

-Cross Line Office and Cross Program activities

multidisciplinary approach

-Combination of field, laboratory, modeling - conduit of information to management

-Robust publication record - over 1500 strong

Strengths, *Challenges*, Solutions

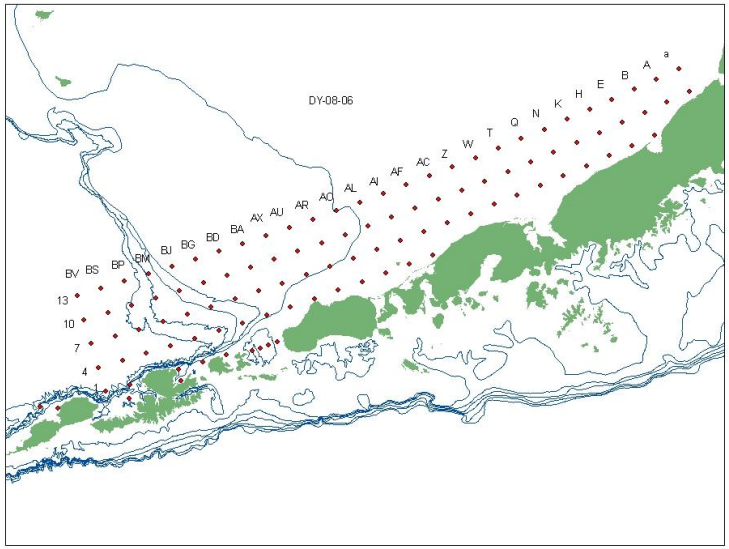
5 LMEs - biennial sampling of key LMEs (BS, GOA), infrequent sampling of others (Beaufort, Chukchi, AIs)

ex: needed supplemental support for 2015 survey in EBS (Ecosystem Shift in progress)

ex: missed the 2014 Warm Blob in the GOA

but...reductions in temporal coverage provided

better spatial resolution in the years sampled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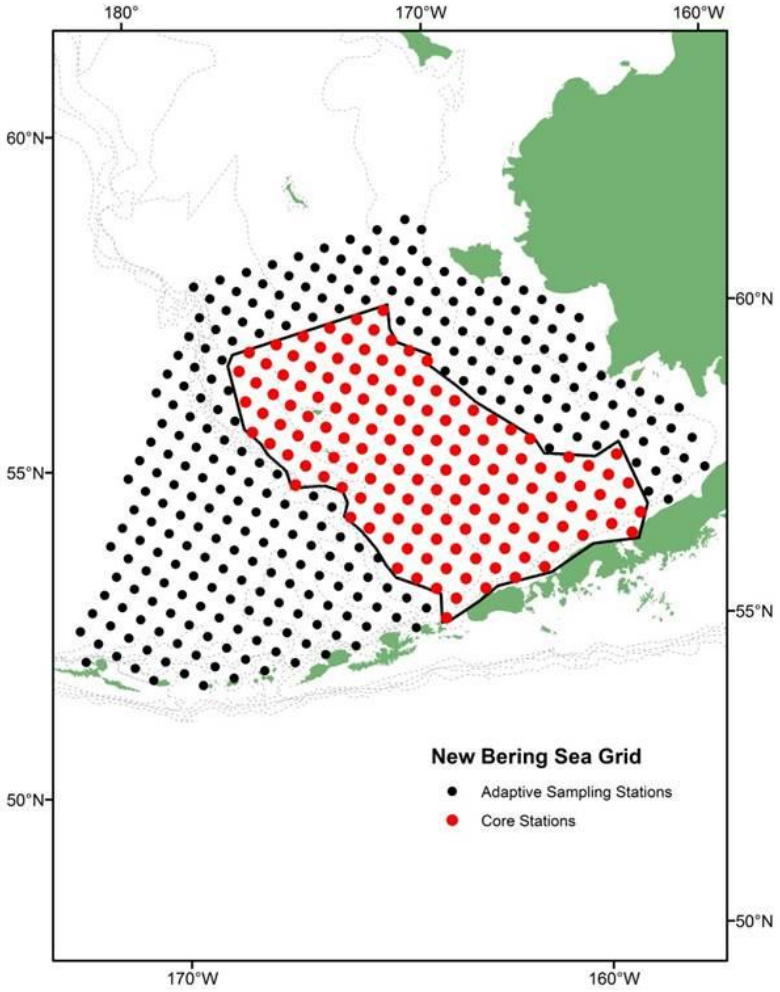
180°
170°W
160°W
60°N
55°N
50°N
New Bering Sea Grid
Adaptive Sampling Stations
Core Stations

Strengths, *Challenges*, Solutions

5 LMEs - biennial sampling of key LMEs (BS, GOA), infrequent sampling of others (Beaufort, Chukchi, AIs)

ex: needed supplemental support for 2015 survey in EBS (Ecosystem Shift in progress)

ex: missed the 2014 Warm Blob in the GOA

but...reductions in temporal coverage provided

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Process vs. Monitoring

IT Support - critical for data collection, management, reporting, web access to data

Strengths, Challenges, *Solutions*

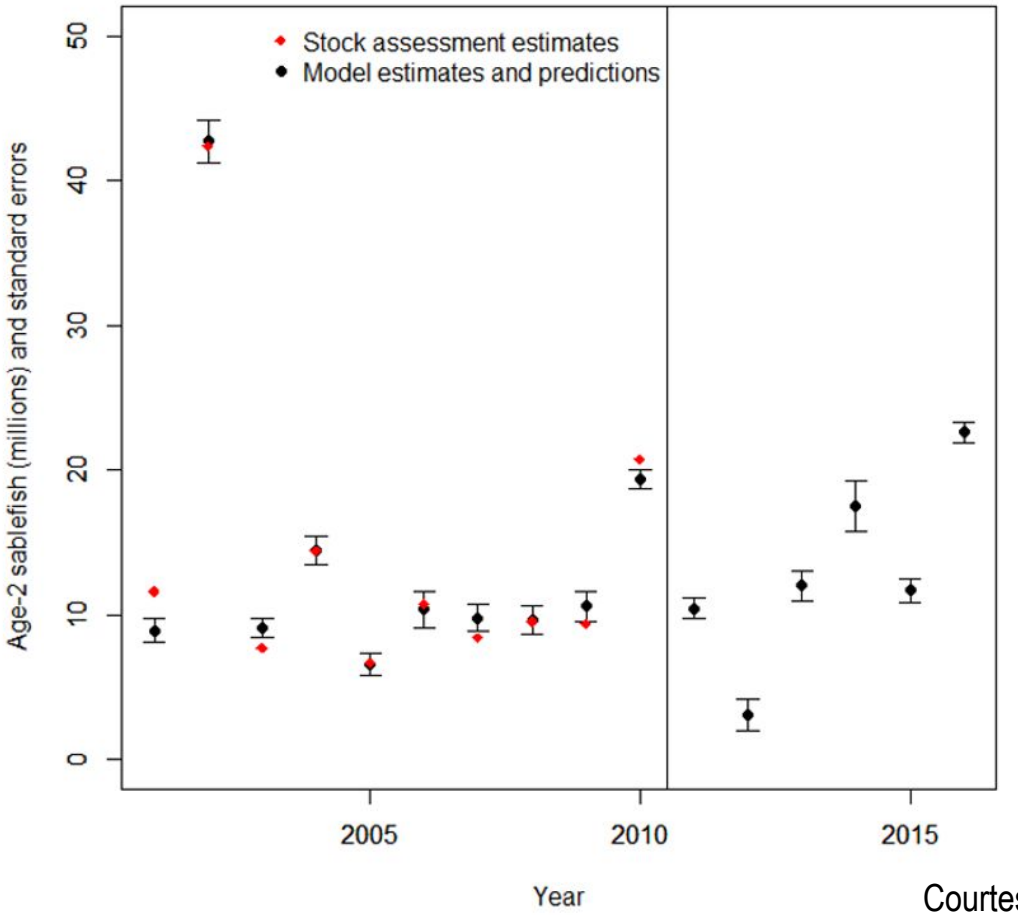
Biennial surveys

Combine surveys with process studies

Rapid, on-board analyses for coarse resolution data for immediate dissemination

Collaborate with Academia, State Agencies & NGOs - fill gaps, share data, maximize efficiencies,

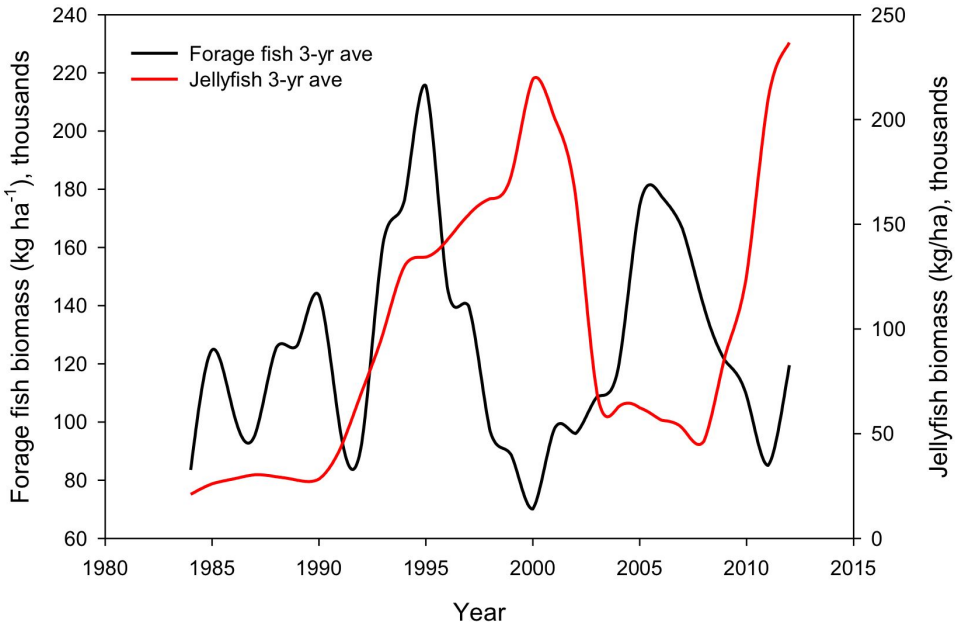
Sablefish recruitment and chla during age-0 year



Courtesy E. Yasumishii
In Zador et al., 2015

Zooplankton (gelatinous)

STORY? Jellyfish may compete with forage fish for zooplankton prey



Courtesy K. Cieciel

- Measure dietary overlap of EBS jellyfish and forage fish
- Examine jellyfish diets, prey digestion rates, and jellyfish abundances and distributions
- Development of indices of competition